

National Center of Mapping and Remote Sensing

Remote sensing techniques for Crop Mapping

LAND USE

crop (different legend)

forest

urban

water...

STATISTICS

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Monitoring of Cereal and Production Forecasting of Wheat and Barley by Remote Sensing

- In partnership with the Ministry of Agriculture
- implemented over a period of three years,
- managed by a technical committee

1. Assessment of Area and cereal production (wheat and barley)
2. Improve methods of existing statistical processes
3. Support decision-making processes (data collection and processing, dissemination).

Long term objective

Design and implementation of an operational system of monitoring and forecasting cereal crops

1. 2009-2010: Data collection and preparation
2. 2010-2011: implementation of the methodology and model parameters
3. 2011-2012: operational forecasting system

Project Components

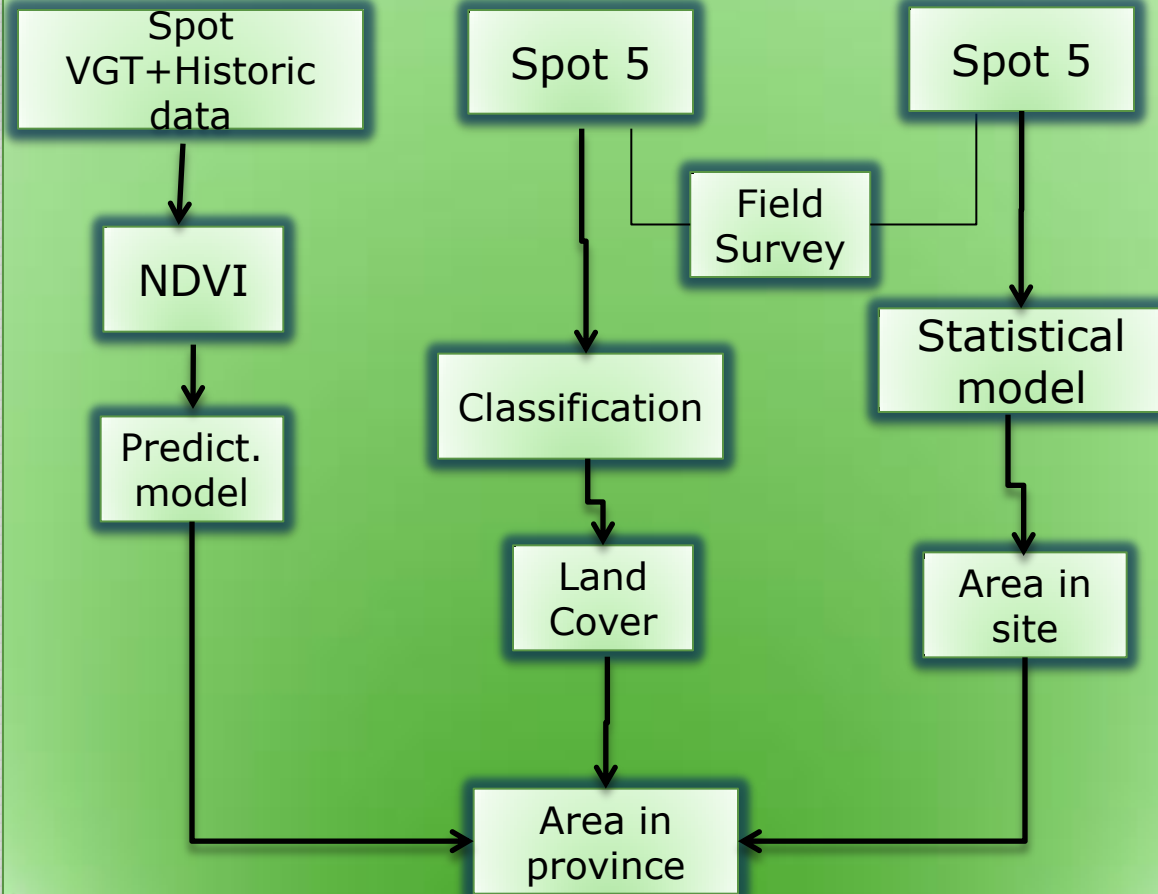
1. area assessment
2. yield evaluation
3. Crop Monitoring

Area estimation

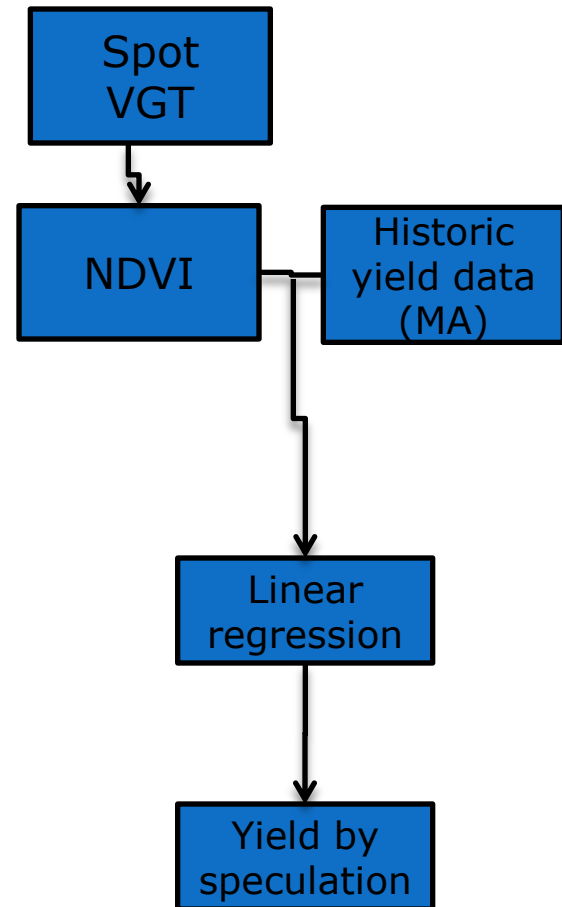
By use Spot VGT

By Classification

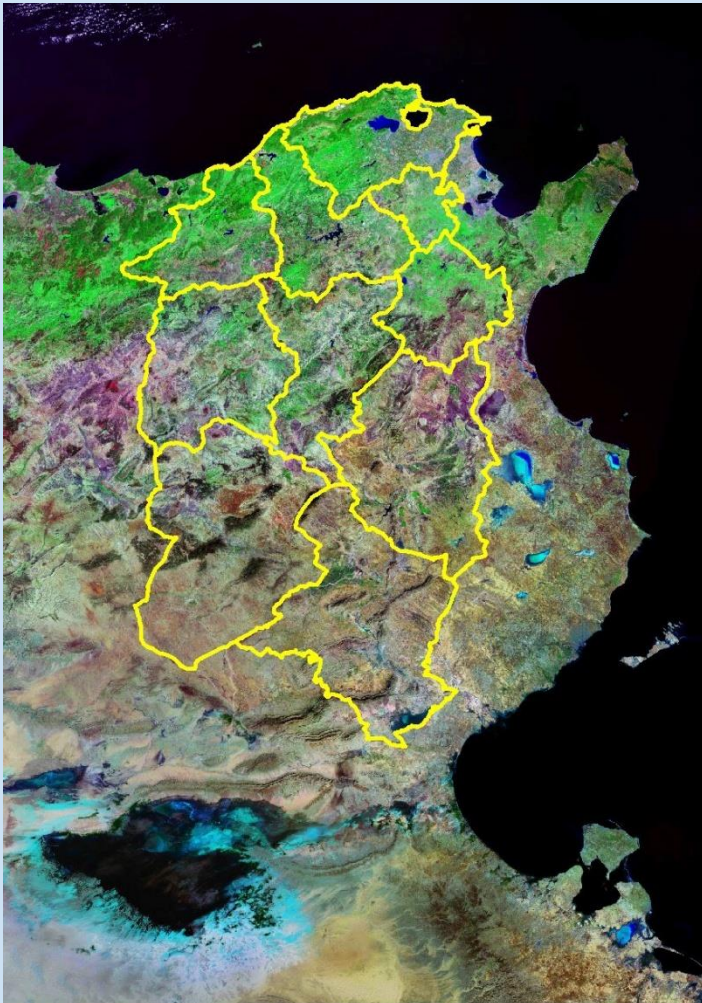
Mars Approach



Yield estimation



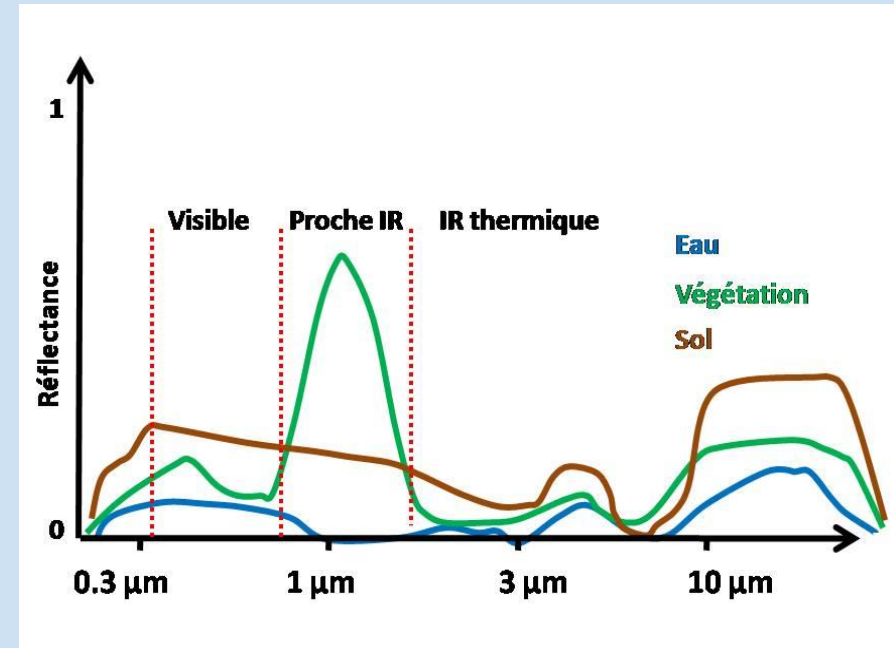
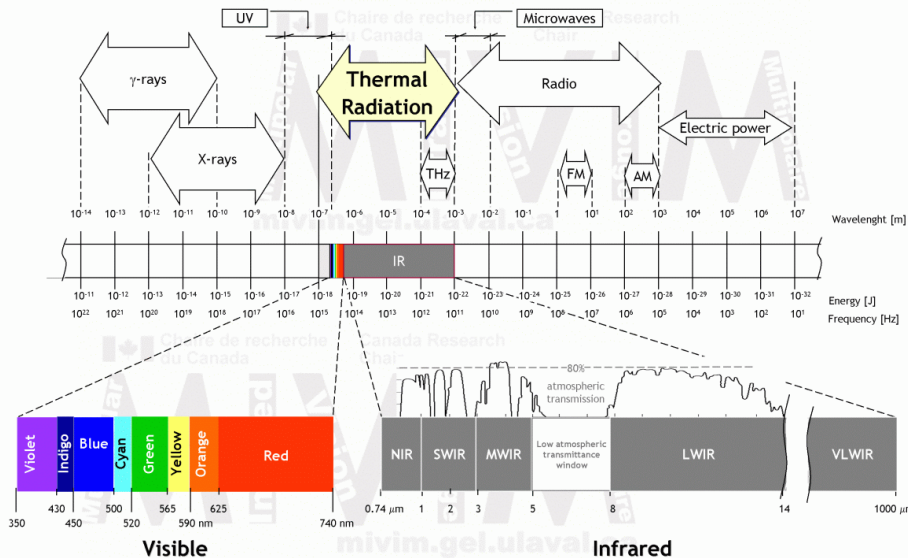
Operational system for monitoring and forecasting cereal crops



10 provinces dominated by
cereal crop

NORTH: Bizerte, Manouba, Béja,
Jendouba, Kef, Siliana, Zaghouan

CENTER: Kairouan, Sidi Bouzid et
Kasserine



The combination of low reflectance in the visible and high reflectance in the near infrared is specific to vegetation:

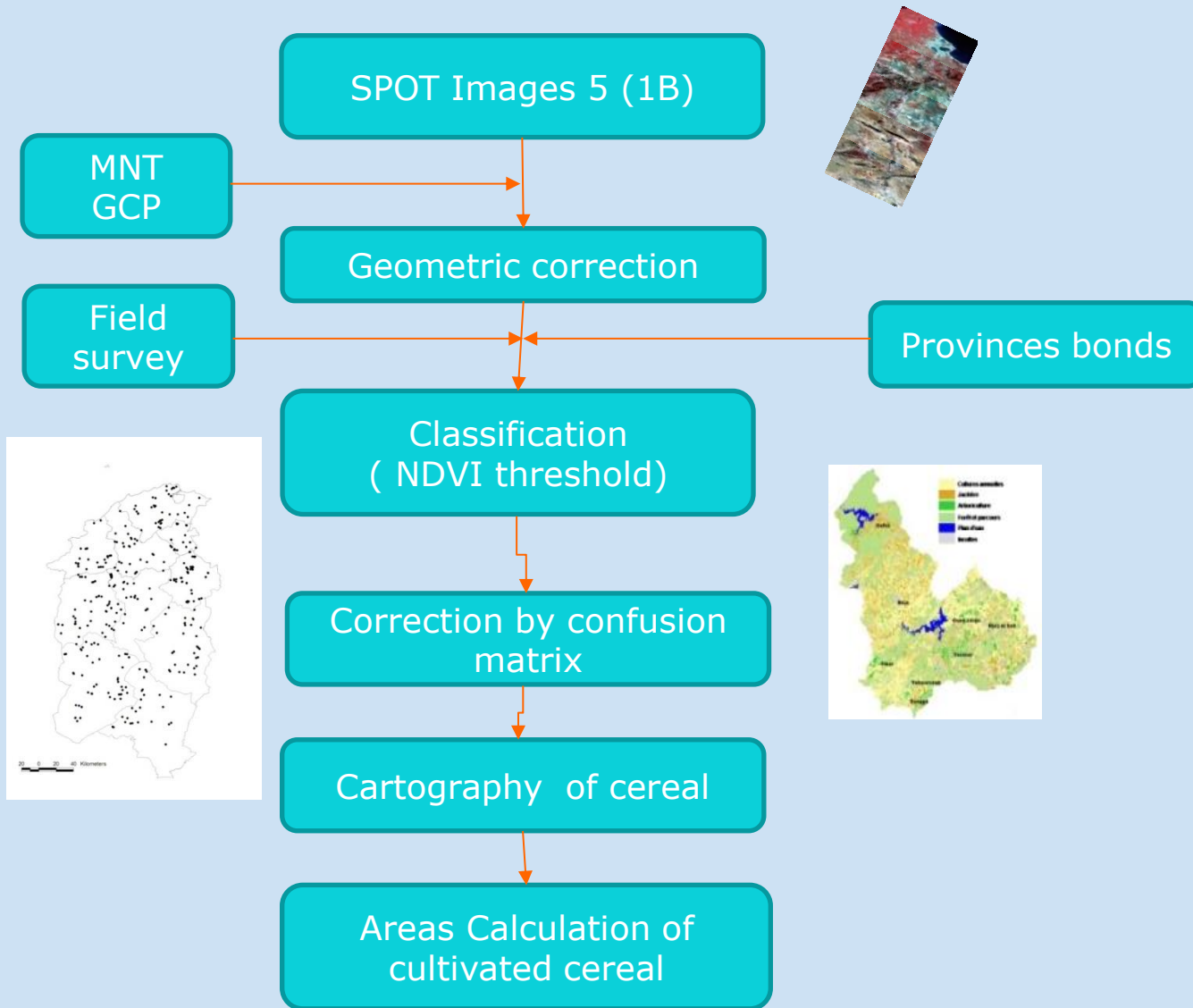
$$NDVI = (NIR - R) / (NIR + R)$$

The NDVI indicates the density and condition of green vegetation, it varies from 0.2 for cereals (for a little ground cover) to 0.8 (grain in good vegetative state, covering completely the ground)

Three approaches

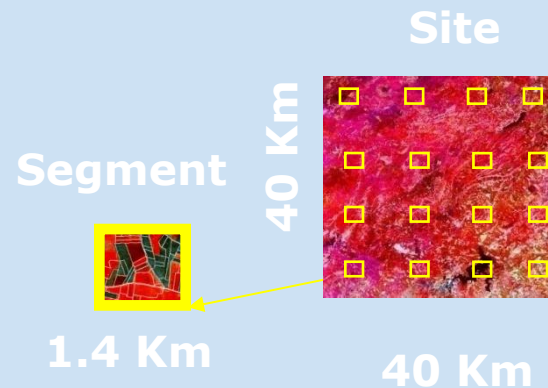
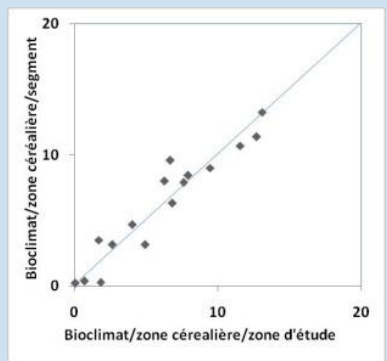
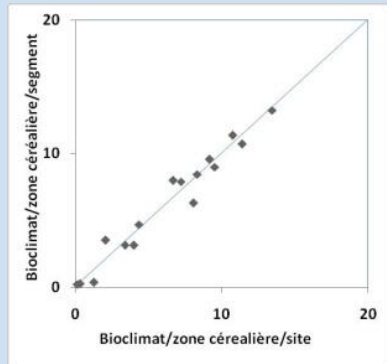
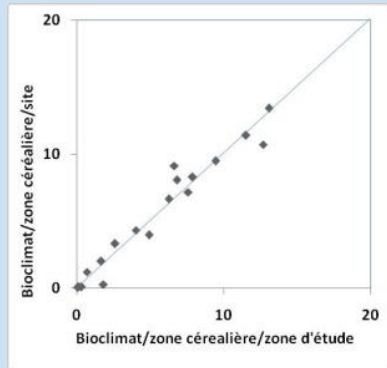
1. Classification method using SPOT5 images
2. Statistical model (Mars Approach, action IV).
3. Statistical method using SPOT VEGETATION images

Classification method using SPOT images 5

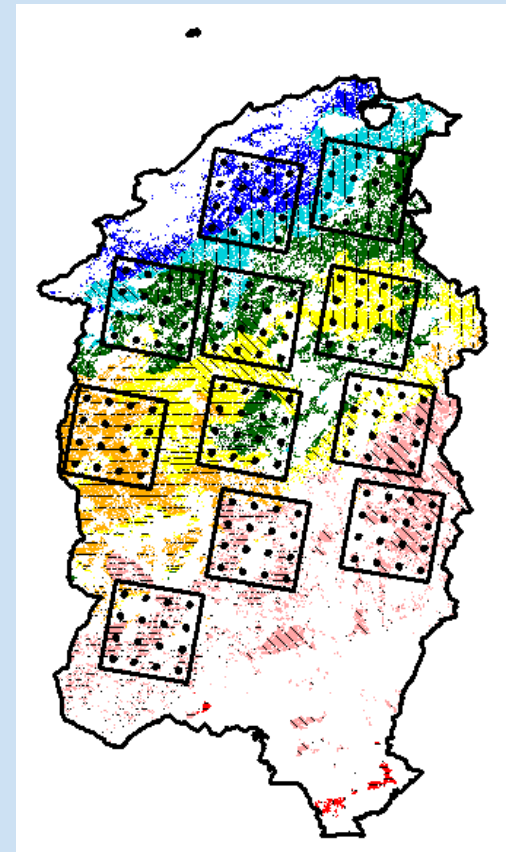


(Monitoring Agriculture with Remote Sensing)

- **Stratification map**
- **Cereal crop map**
- **The SPOT satellite track**



11 sites



MARS's approach

In site

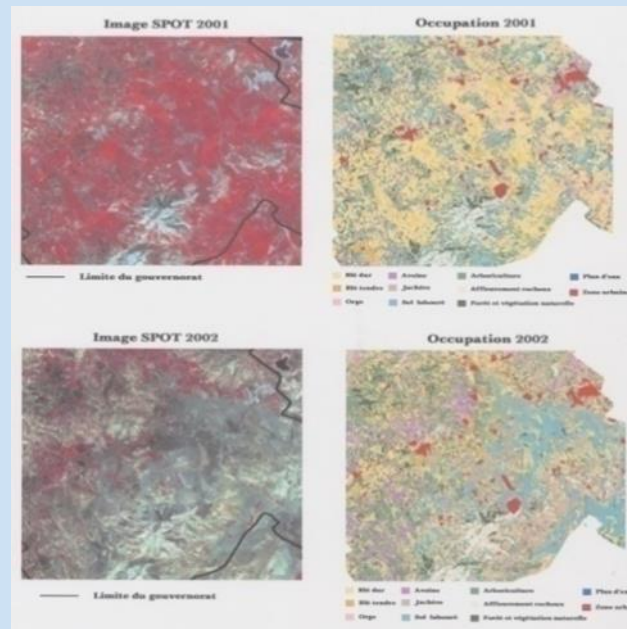
$$\Delta S = (S_n - S_{n-1}) / S_{n-1}$$

Estimated area in the site year (n-1)

S_{n-1}

Estimated area in the site year (n)

S_n



In province

$$S_n = (\Delta S + 1) \times S_{n-1}$$

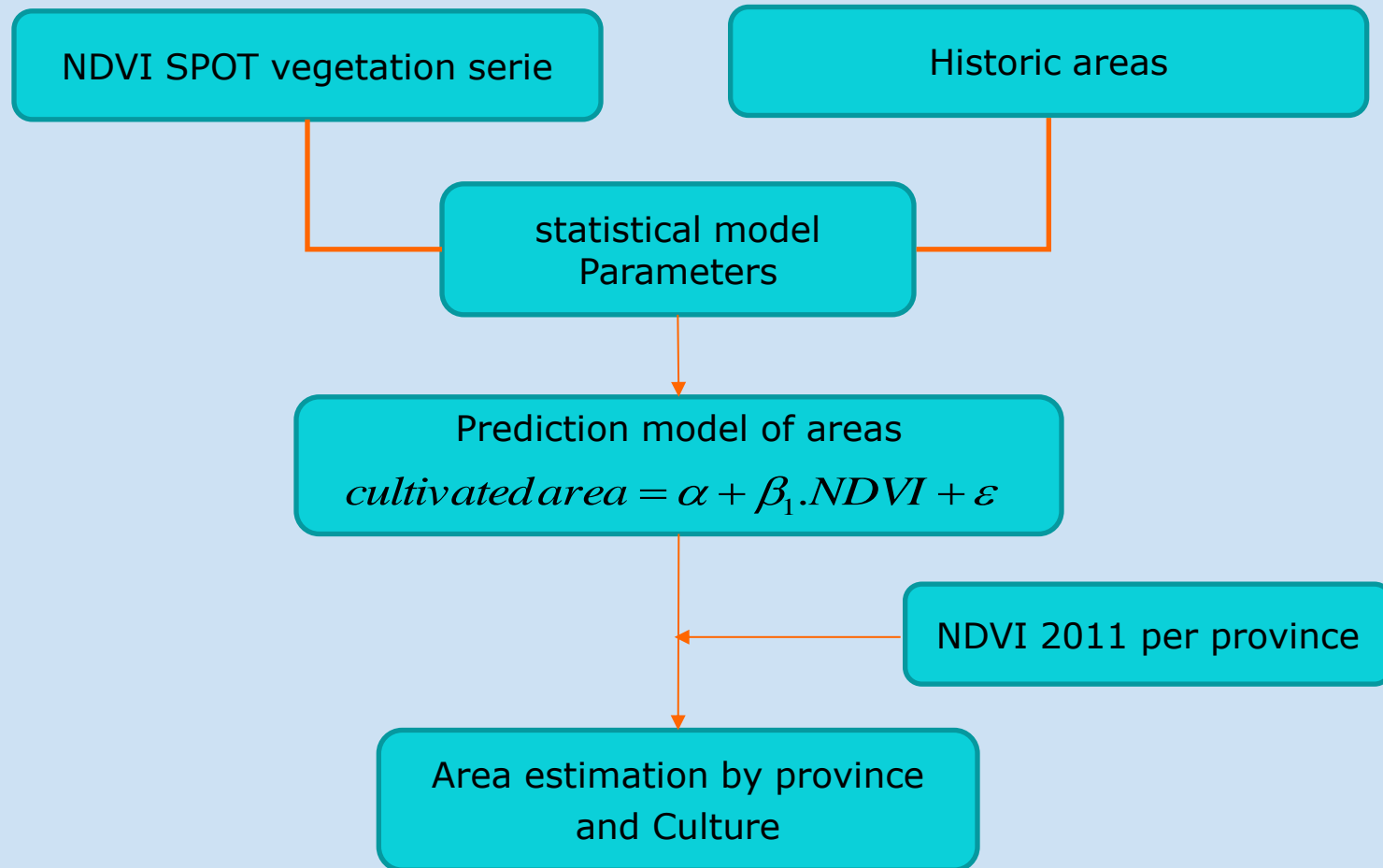
Estimated area in the province (MA) year (n-1)

S_{n-1}

Estimated area in province year (n)

S_n

Statistical method using SPOT VGT images



Statistical approach : Linear regression

$$Yield = \alpha + \beta_1.NDVI + \varepsilon$$

β_1 : regression coefficient

α : Origin value

ε : Error

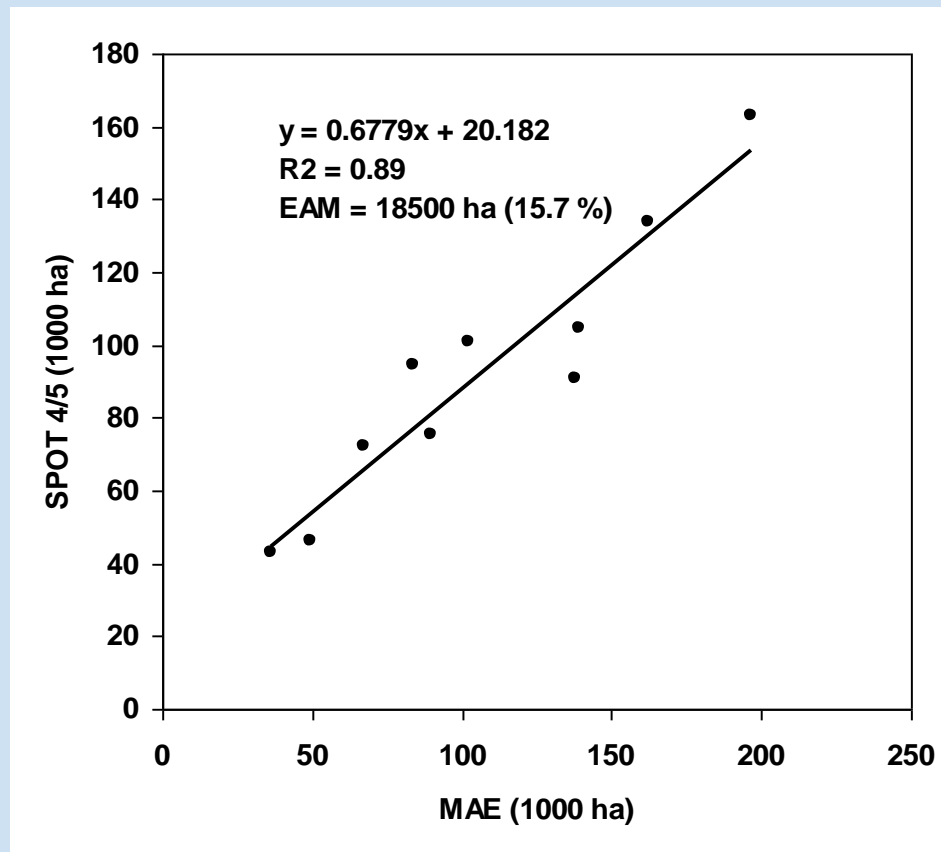
$NDVI$: Normalised Difference Vegetation Index

$YIELD$: Yields of Durum Weat, Bread Weat and Barly

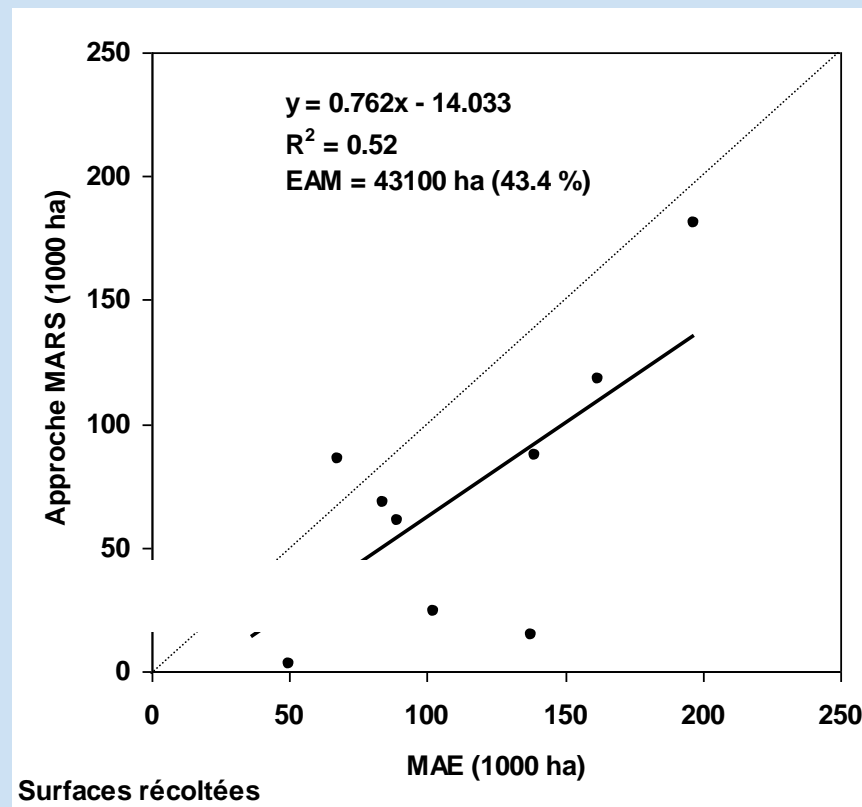
Various parameters for each cereal type and province

CEREAL AREAS ASSESSMENT

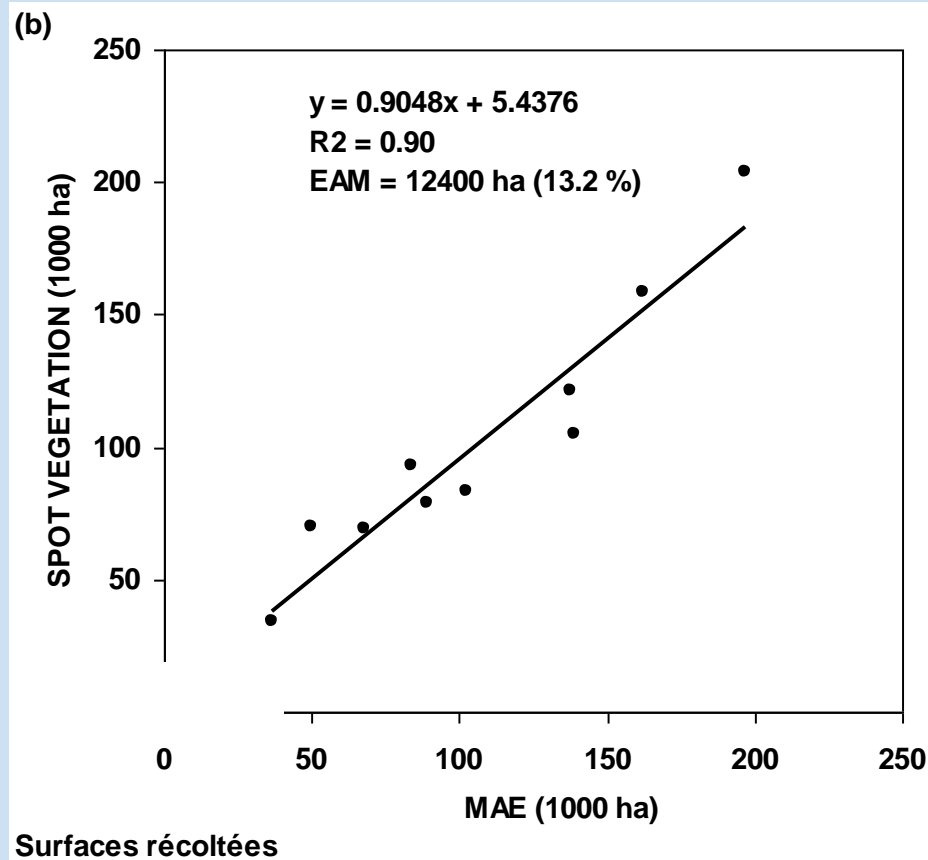
Approach 1: NDVI threshold per scene SPOT 5 & per date



Approach 2: MARS's Method



Approach 3: NDVI SPOT VEGETATION



The cereal production estimation is the result of multiplying the cereal yield of each cereal speculation by the study area surface

National production 2011

Millions of Qx

	MA	CNCT	Difference
Durum Wheat	13,2	11,6	- 12,1
Soft Wheat	2,8	2,5	- 10,7
Barley	6,8	5,0	-26,5
Total	22,8	19,1	-16,2

At the end of 1st and 2nd phases of the project, the following actions were carried out:

- Data collection and processing
- Implementation of a methodology
- Cereal crop monitoring 2009-2010 and 2010-2011
- Edition of a bulletin of cereal crop monitoring 2011 and 2012
- Cereal area assessed with three different approaches
- Cereal yield estimation

Good results obtained

But there is need to

- Continue to improve the methodology
- Increase its efficiency by using an adequate sampling rate and/or by use of another sampling protocol system
- Implement this operational system for forecasting and monitoring cereal crop

LEVEL OF IMAGE PROCESSING & RS

Way Forward:

- Project continuation
- Extend to all of types of crop
- Understand the techniques based on LAI & FPAR
- Perform knowledge and training in modeling and how to get the images in LAI, FPAR, dry matter, Phenology, ETP ...

Actions in the frame of the project :

- Training on C++ and IDL programming (automated processing chains, MVC, algorithms for cloud processing...)
- Training on modeling and image collection in LAI, FPAR, dry matter, phenology, ETP, etc.
- Training on atmospheric corrections

AT LEVEL OF AGRICULTURE MANGEMENT WATER USE, information crop&irrigation

- Irrigated field (public “known” , private??)
- Crop mapping.

Axe irrigation for LDAS Project : Same end-users of the agriculture ministry additional DG rural engineering and water exploitation

End-users' needs?

- information about different types of crop (spatialisation, type, state...) adapted to tunisian landscape specificities
- Information about the stressed crop and how and when use of water resource (quantity, quality)
- cropmapping

THANK YOU
FOR YOUR ATTENTION